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An Announcement of Highway Safety Literature ... A Bi-Monthly Abstract Journal

HSL No. 72-16 August 25, 1972 HS-011 340 - HS-011 408, HS-800 661, 669, 671-672, 676, HS-810 205, 210 - 211, 214,
HS-820 188 & 198



HSL No. 72-16
August 25, 1972



SPECIAL ANNOUNCEMENT
ON PAGE 23

THIS ISSUE CONTAINS:

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U.S. Department of Transportation / National Highway Traffic Safety Administration

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An Announcement of
HIGHWAY SAFETY LITERATURE
... A Bi-Monthly Abstract Journal

Published twice-a-month by the National Highway Traffic Safety Administration,
Research Institute, Office of Accident Investigation and Data Analysis
Washington, D.C. 20590

INTRODUCTION

Publications such as journal articles, proceedings, and research reports announced in *Highway Safety Literature* include some of the most recent additions to the collection of the NHTSA Scientific & Technical Information Service. Subject areas covered include all phases of highway, motor vehicle, and traffic safety, especially those encompassed by the National Traffic and Motor Vehicle Safety Act of 1966 and the Highway Safety Act of 1966.

Individual issues of *HSL* are numbered according to the year and the issue number within that year; thus, 72 designates the year and 1, 2, 3, etc. the individual issues. To aid the user in locating citations by the HS-number, the cover bears the inclusive entry number for each issue.

Entries in *HSL* are arranged according to the NHTSA Subject Category List shown in the Table of Contents. The list is a two-level arrangement consisting of five major subject fields subdivided into 59 subject groups. Documents related directly to

the National Highway Traffic Safety Administration (NHTSA) are announced in a separate section headed NHTSA DOCUMENTS and are numbered in five distinct series: NHTSA Accident Investigation Reports (HS-600 000 series), NHTSA Compliance Test Reports (HS-610 000 series), NHTSA Contractors Reports (HS-800 000 series), NHTSA Staff Speeches, Papers, etc. (HS-810 000 series), and NHTSA Imprints (HS-820 000 series). For NHTSA DOCUMENTS in series HS-600 000 and HS-610 000, individual full case reports are available for inspection at the National Highway Traffic Safety Administration. HS-800 000 series and HS-820 000 series are available for purchase from NTIS or GPO (see page ii). Although announced together in a separate section, these documents are also assigned specific subject categories for machine retrieval.

A document which contains a number of separate articles is announced as a complete volume in the subject category most applicable to it as a whole. Entries for the individual articles appear in their most specific subject category.

SAMPLE ENTRIES

Subject Category Array	
NHSB Accession no	HS-800 218 Fld. 5/21; 5/9
Title of document	AN INVESTIGATION OF USED CAR SAFETY STANDARDS--SAFETY INDEX: FINAL REPORT. VOL. 6 - APPENDICES G-L
Personal author(s)	by E. N. Wells; J. P. Fitzmaurice; C. E. Guilliams; S. R. Kalin; P. D. Williams
Corporate author	Operations Research, Inc.
Collation	
Publication date	1969 150p Contract FH-11-6921 Report no. ORI-TR-553-Vol-6; PB-190 523
Abstract	Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks. Search terms; Wear; Trucks; Failures; Used cars; Inspection standards

AVAILABILITY: NTIS

HS-004 497 Fld. 5/19

AUTO THEFT--THE PROBLEM AND THE CHALLENGE

by Thomas A. Williams, Sr.

Journal citation Published in *FBI Law Enforcement Bulletin* v37 n12 p15-7 (Dec 1968)

Gives figures on the extent of the auto theft problem and comments on anti-theft devices available now or in the planning stage.

Search terms: Theft; Theft protection; Stolen cars

(Note: If the date of a report or Journal article is not given, the small letters nd will appear)

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NOTE: Material published in Highway Safety Literature (HSL) is intended for the information and assistance of the motor vehicle and highway safety community. While brand names, equipment model names and identification, and companies may be mentioned from time to time, this data is included as an information service. Inclusion of this information in the HSL should not, under any circumstances, be construed as an endorsement or an approval of any particular product, course, or equipment by the U.S. Department of Transportation, National Highway Traffic Safety Administration.

Harry A. Feinberg
Managing Editor

AVAILABILITY OF DOCUMENTS AND INSTRUCTIONS FOR ORDERING

Articles and reports whose citations and abstracts appear in HSL are acquired from many sources, such as periodicals, journals, NHTSA Contractors' reports and NHTSA staff speeches, and other reports. Those reports other than NHTSA Contractors' reports and NHTSA generated reports and speeches (see introduction) are assigned a lower consecutive accession (HS-) number.

Department of Transportation personnel may borrow copies of publications announced in HSL from the NHTSA Technical Reference Division. Non-DOT Personnel, in the Washington, D.C. area, may borrow copies of publications for a 24-hour period only. Telephone (202) 426-2768. Government personnel in the Washington, D.C. area, use government ID phone 118-62768.

The names of the journals cited in HSL appear in *italic type* preceded by the words "Published in." The journal containing the article cited may be borrowed from most research and public libraries. Non-DOT personnel outside the Washington area should contact their company or agency libraries for assistance.

(Use any of the most recent *periodical directories* for location and price of publications cited in HSL)

NHTSA Contractors' reports and other reports can usually be obtained as indicated under AVAILABILITY. However, there is no certainty that copies will be available for more than a limited period after a report is issued.

The more common availability sources are identified by symbols which are explained in the next column:

NTIS: National Technical Information Service, Springfield, Va. 22151. Order by accession number: HS, AD, or PB. Prepayment is required by NTIS coupon, check or money order (made payable to NTIS). GPO coupons are not acceptable. Documents are available in paper copy (PC); in full size original or reduced facsimile, and on microfiche (MF) a 4x6" negative sheet of film (reader required).

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Give corporate author, title, personal author, and report number. Prepayment is required by GPO coupon (NTIS coupons are not acceptable), check or money order (made payable to the Superintendent of Documents).

HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N. W., Washington, D. C. 20418.

NHTSA: National Highway Traffic Safety Administration, General Services Division, Washington, D.C. 20591 (Telephone (202) 426-0874), Give HS-No.

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. Order by SAE report numbers. Prices given are list; discounts are available to SAE members and sometimes to libraries and U.S. Government Agencies. Prepayment is required; orders received without payment are subject to a \$1 handling charge.

IMPORTANT NOTICE

WHEN REQUESTING a document, to be absolutely sure you receive what you order, give the accession number (HS, PB, AD number) or report number (in cases such as an SAE document), title of report, and the personal or corporate author (whichever is cited). When requesting an HS-numbered document from NTIS, add DOT/to the prefix HS-; example HS-800 000 should be ordered as DOT/HS-800 000.

1/0 ACCIDENTS**1/4 Locations****HS-011 340 Fld. 1/4****A SYSTEM TO IDENTIFY HAZARDOUS LOCATIONS AND ELEMENTS**

by Ralph R. Bartelsmeyer

Published in *Traffic Quarterly* v26 n1 p5-13 (Jan 1972)

A systematic approach to identify accident locations should include four factors: reports of all accidents with \$100-200 damage; location information of sufficient accuracy to spot accidents within one-tenth of a mile; accident circumstances and environmental information to permit the identification of causal factors; and a storage and retrieval system. Improvements needed in present accident record systems are discussed. Once accident locations are identified, a procedure for establishment of priorities is needed. Cost effectiveness should be considered in the ranking process.

Search terms: Accident location; Highway improvements; Damage costs; Environmental factors; Accident causes; Accident records; Priorities; Benefit cost analysis; Data acquisition

1/5 Statistical data**HS-011 341 Fld. 1/5; 4/5****COLLISION DATA GATHERING AND ANALYSIS PROJECT. FINAL REPORT.**

Michigan Univ. Hwy. Safety Res. Inst.

1971 39p.

Grant UM-7003-G129

Supported by a grant from the Automobile Manufacturers Association.

The objective of the data collecting program was to establish a base line of

driver, vehicle, highway, and exposure data within Washtenaw County, Michigan, and to collect the police reported accidents within the county. Data were then collected from other Michigan files and from other states. The second part of the study was in-depth, off-scene accident studies to provide about 350 case reports on accidents resulting in little or no injury to occupants but enough damage to the vehicle to require towing. Variables in the files and details of the programs are described.

Search terms: Data analysis; Data acquisition; Michigan; Accident reports; Accident statistics; Accident studies; Accident case reports; Property damage accidents; Variables; Computer programs; Automated accident records; Accident risks; Driver vehicle road interfaces; Accident analysis

2/0 HIGHWAY SAFETY**HS-011 342 Fld. 2/0****TRAFFIC SAFETY IS LOW MAN ON THE TOTEM POLE**

by Howard Pyle

Published in *Traffic Safety* v72 n1p8-10, 36-7 (Jan 1972)

The president of the National Safety Council points to inequities in federal funding of safety programs. Federal legislation has not been adequately supported by appropriations. The highway accident rate is at least 50% higher than the work accident rate for fatalities, and highway safety programs deserve better funding.

Search terms: Highway safety programs; Federal laws; Appropriations; Accident rates; Fatality rates; Industrial accidents; Vehicle accidents

2/4 Design and Construction**HS-011 343 Fld. 2/4****DEVELOPMENT OF A TEXTURE PROFILE RECORDER. RE-****SEARCH REPORT FOR A PILOT STUDY TO DETERMINE THE DEGREE OF INFLUENCE OF VARIOUS FACTORS PERTAINING TO THE VEHICLE AND THE PAVEMENT ON TRAFFIC ACCIDENTS UNDER WET CONDITIONS**

by B. H. Ashkar

Texas Hwy. Dept.

1970 31p 5refs
Report no. RR-133-2

In cooperation with Bureau of Public Roads.

Surface texture is one of the main factors that influences the skid resistance and the possibility of hydroplaning on wet pavements. To determine a minimum level of skid resistance that should be possible, a knowledge of the drainage characteristics of the roadway surface is required. A texture profile recorder was fabricated to determine the local variations in surface geometry. Sites of accidents which occurred under wet conditions were surveyed. It was concluded that a texture profile recorder for field use should be a simple, portable, mechanical device that could be handled by one man and record enough length of the road to be representative of the area surveyed.

Search terms: Pavement surface texture; Pavement skidding characteristics; Pavement tests; Pavement skid resistance; Measuring instruments; Drainage; Accident location; Wet road conditions; Wet skidding; Hydroplaning; Skidding accidents

2/9 Traffic Control**HS-011 344 Fld. 2/9; 4/7****A PROBABILISTIC APPROACH TO TRAFFIC PROBLEMS: PHASE 2. FINAL REPORT**

by Robert J. Serfling; Ismael N. Shimi

2/9 Traffic Control (Cont'd.)

HS-011 344 (Cont'd.)

Florida State Univ.

1970 184p

Contract FH-11-6890

Report no. PB-199 433

Includes HS-011 345 through HS-011 352

Eight technical reports relating to the application of mathematical tools, including stochastic point processes, to model traffic flow, and to the development of a macroscopic traffic model to determine the concentration and volume of cars at each point along a highway under various conditions are described and appended.

Search terms: Stochastic processes; Stochastic traffic flow models; Macroscopic traffic flow theory; Traffic models; Traffic density; Probability theory; Equations

AVAILABILITY NTIS as PB-199 433

HS-011 345 Fld. 2/9; 4/7

FUNDAMENTAL RELATIONSHIPS FOR TRAFFIC FLOW MODELS WITH APPLICATIONS

by Robert J. Serfling

Florida State Univ.

Published in HS-011 344, *A Probabilistic Approach to Traffic Problems: Phase 2*, Tallahassee, 1970 p021-71

27refs

Contract FH-11-6890

Report no. FUS-Statistics-M154

A careful description of how traffic flow may be viewed as a stochastic point process is provided. Several types of theoretical relationships are presented. Intervals between events are related to

counts of events within intervals. Synchronous observation, commencing with an observed event, is related to asynchronous observation, which commences at a point randomly located with respect to the stream of events. Some relationships between marginal and joint probability distributions are given. The utility of these relationships in the analysis of traffic flow models is illustrated as follows: the role of the renewal function in the case of non-renewal processes is assessed and the Poisson process, the Erlang process, and the Polya process are examined. Concerning the latter two processes, some new results are obtained, including useful details about the correlations.

Search terms: Traffic flow; Traffic models; Stochastic processes; Stochastic traffic flow models; Mathematical models; Poisson density functions; Erlang process; Polya process; Event rates

HS-011 346 Fld. 2/9; 4/7

NON-POISSON MODELS FOR TRAFFIC FLOW, 2

by Robert J. Serfling

Florida State Univ.

Published in HS-011 344, *A Probabilistic Approach to Traffic Problems: Phase 2*, Tallahassee, 1970 p072-84

3refs

Contract FH-11-6890

Report no. FSU-Statistics-M155

The equations given offer a certain approach for development of models for traffic flow having greater validity than the Poisson. An advantage of this approach is that no restriction on the dependence structure need be imposed. Another useful feature is the intuitive basis provided through the probabilistic interpretation of the constants. However, the practical value of the approach nevertheless depends upon the mathematical tractability of the models it

provides. Here, results so far have been rather negative. In order to have general solutions simple enough to have practical appeal, it is necessary to restrict the form of the constants. Even so, the initial study treated only the two simplest cases. In the first case, the solution is found to be the Poisson model. In the second, the only tractable solution appears to be a negative binomial model. Since neither of these models is suitable for traffic flow, it is necessary to undertake a tractable solution of equations of more complicated form.

Search terms: Poisson density functions; Traffic models; Probability theory; Equations; Mathematical models; Traffic flow

HS-011 347 Fld. 2/9; 4/7

CONCENTRATION OF CARS IN A MACROSCOPIC STUDY OF TRAFFIC FLOW. 1. STEADY STATE

by Ismael N. Shimi

Florida State Univ.

Published in HS-011 344, *A Probabilistic Approach to Traffic Problems: Phase 2*, Tallahassee, 1970 p085-102

13refs

Contract FH-11-6890

Report no. FSU-Statistics-M156

Concentrations of cars in two adjacent parts of a highway are determined as functions of the position x and the time t . The two parts of the roadway are assumed to have different road characteristics. Cars can only enter that stretch of the highway from one end of it, and can only leave it from the other end. We assume constant concentration of cars at the entrance. We also assume that there exist two limiting concentrations for the two parts of the road, such that cars can no longer pass in a part of the road when the concentration in that part reaches its

limiting value. The system starts with the road closed and the concentration in each part of the road at its limiting value. At time $t=0$, the flow starts out of the exit at a constant rate. Considering cars as molecules in a simple diffusion process, the concentrations are given in terms of rapidly converging series for large values of t . It is also pointed out how these results can be used to determine the actual steady state speed distribution functions for the inhomogeneous case produced by Prigogine, Herman, and Anderson.

Search terms: Traffic density; Traffic flow; Traffic models; Mathematical models; Macroscopic traffic flow theory; Steady state; Equations

HS-011 348 Fld. 2/9; 4/7

CONCENTRATION OF CARS IN A ROAD WITH NON-STATIONARY INFLOW AND OUTFLOW

by Ismael N. Shimi

Florida State Univ.

Published in HS 011 344, *A Probabilistic Approach to Traffic Problems: Phase 2*, Tallahassee, 1970 p103-15

14refs

Contract FH-11-6890

Report no. FSU-Statistics-M157

The problem of determining the concentrations, as functions of the position and the time t , in two adjacent parts of a roadway is discussed. It is shown that, if the only conservation law valid for the description of traffic flow, then the movement of cars can be described by the simple diffusion equation. Solutions in terms of rapidly converging series, especially for small time t . This form of the solution is particularly useful when the exit of this roadway is controlled by a traffic signal with a short cycle.

Search terms: Traffic flow; Macroscopic traffic flow theory; Equations; Traffic models; Mathematical models; Unsteady state

HS-011 349 Fld. 2/9; 4/7

CONCENTRATION OF CARS IN A ROAD WITH NON-STATIONARY INFLOW AND OUTFLOW

by Ismael N. Shimi

Florida State Univ.

Published in HS-011 344, *A Probabilistic Approach to Traffic Problems: Phase 2*, Tallahassee, 1970 p116-26

14refs

Contract FH-11-6890

Report no. FSU-Statistics-M158

The concentration of cars at each point of a stretch of highway is determined, assuming non-stationary inflow at the entrance, and a non-stationary outflow from the exit. This is analogous, in the microscopic case, to assuming non-stationary rate of arrival and non-stationary service rate.

Search terms: Traffic flow; Traffic models; Equations; Mathematical models; Traffic density

HS-011 350 Fld. 2/9; 4/7

THE VARIANCE FUNCTION OF THE ERLANG PROCESS

by Robert J. Serfling

Florida State Univ.

Published in HS-011 344, *A Probabilistic Approach to Traffic Problems: Phase 2*, Tallahassee, 1970 p127-45

11refs

Contract FH-11-6890

Report no. FSU-Statistics-M164

The Erlang model for traffic flow has desirable features from a qualitative standpoint but has realized only limited use due to mathematical untractability. In this report, a relatively simple exact expression of closed form is obtained for the variance $\sigma^2(t)$ of the asynchronous counting distribution for a counting period of length t , t greater than zero. Useful bounds are placed upon the error of the linear approximation to $\sigma^2(t)$. Implications of these results are examined. In particular, a new exact expression and related bounds are obtained for the mean function of the synchronous counts (also known as the renewal function of the process). All bounds given are sharp in asymptotic order of magnitude as the length of the counting period is allowed to increase.

Search terms: Erlang process; Traffic flow; Traffic models; Mathematical models; Equations; Parameters

HS-011 351 Fld. 2/9; 4/7

A MACROSCOPIC STUDY OF TRAFFIC FLOW

by Ismael N. Shimi

Florida State Univ.

Published in HS-011 344, *A Probabilistic Approach to Traffic Problems: Phase 2*, Tallahassee, 1970 p146-61

19refs

Contract FH-11-6890

Report no. FSU-Statistics-M172

A solution for the flow function in a finite homogeneous part of a roadway is provided. It is shown that, if the conservation of the number of cars is the only conservation law valid for a macroscopic description of traffic flow, the movement of cars can be described by a simple diffusion equation. We shall consider as infinite stretch of roadway composed of two homogeneous adjacent parts, one of them of finite length. Cars can only enter that finite part from one

2/9 Traffic Control (Cont'd.)**HS-011 351 (Cont'd.)**

end of it, and leave from the other. Assume the concentration of cars at the entrance is constant, and the initial flow in the finite part is constant. Also assume the initial flow in the infinite part is given by any function of the position in that part. In addition, assume that cars do not accumulate at the boundary point between the two parts of the roadway. The traffic flow at the far end of the infinite part is assumed to be stable. Under these initial and boundary conditions the flow function in the finite part is given as a function of the position and the time. It is shown that the flow in the finite part is always greater than or equal to the initial flow in that part, and the maximum flow is always attained at both the entrance and the exit.

Search terms: Macroscopic traffic flow theory; Traffic density; Equations; Traffic flow; Traffic models; Mathematical models

HS-011 352 Fld. 2/9; 4/7**A CLASS OF STOCHASTIC POINT PROCESS MODELS FOR TRAFFIC FLOW**

by Robert J. Serfling

Florida State Univ.

Published in HS-011 344, *A Probabilistic Approach to Traffic Problems: Phase 2*, Tallahassee, 1970 p162-80

17refs
Contract FH-11-6890
Report no. FSU-Statistics-M177

The problem of construction of an appropriate counting model for traffic flow is dealt with. In continuation of the investigation in previous reports, the present report gives a fuller treatment of the formal specification of a point process and treats of the nonstationary case. Also, a certain class of (non-

Poisson) models that appear roughly appropriate for traffic flow is distinguished. It is seen that a Negative Binomial model, like the Poisson, is too extreme a departure from what is appropriate for traffic flow.

Search terms: Traffic flow; Traffic models; Stochastic traffic flow models; Equations; Poisson density functions; Binomial density functions; Mathematical models

HS-011 353 Fld. 2/9**REFLECTIVE TRAFFIC BEAD STUDY. FINAL REPORT**

Colorado Dept. of Highways

1970 51p

In cooperation with Bureau of Public Roads.

Evaluation of a new floating type of traffic bead by the Colorado Division of Highways shows that these small uniformly-graded beads are superior in both brightness and durability to the coarser traffic beads that the State had been using. The tests were performed on centerline stripes placed on both asphalt and concrete surfaces. During the three year test period, the brightness of 78 test sections was evaluated by human evaluation teams and by a photometer developed during the project. Plans for the construction of these photometers are included in the report as an aid to others who may want to evaluate bead performance.

Search terms: Glass beads; Brightness; Materials tests; Performance tests; Durability tests; Photometers; Centerline markings; ReflectORIZED pavement markings

HS-011 354 Fld. 2/9**PAINT STRIPE AND GLASS BEAD STUDY. REPORT 2. GLASS BEADS IN PAINT**

by Carl F. Crumpton; George A. McCaskill

Kansas Highway Commission

1970 47p 16refs
Report no. PB-196 404

Laboratory equipment was used to study the performance of glass beads in paint. Surface and abrasion equipment was used to study wear and abrasion of beads and paint; cores and linear traverse equipment were used to measure road surface texture; binocular and petrographic microscopes were useful in studying paint and bead problems. A vertical illuminator attachment on a microscope was used to simulate normal headlight angles. With these techniques, much of the engineering of bead size to fit paint film thickness can be done in the laboratory with a minimum of field tests being necessary. The laboratory research cost about \$20,000 but has saved about \$324,000 in paint and beads. Other savings have been used to pay for additional edge lines.

Search terms: Glass beads; Pavement markings; Paints; Laboratory tests; Materials tests; Wear tests; Pavement surface texture; Microscopes; Measuring instruments; Benefit cost analysis; Headlamp usage; Performance tests; Abrasion tests

AVAILABILITY: NTIS as PB-196 404

HS-011 355 Fld. 2/9**AUTOMATED HIGHWAYS TRAFFIC MANAGEMENT STRATEGY**

by Robert G. Stefanek; Stephen J. Kiselewich

Published in *Automotive Engineering* v80 n1 p20-7 (Jan 1972)

The success of urban automated vehicle networks will depend on efficient traffic

management. Cycle proprogramming appears to be a strategy capable of coordinating vehicle flows in a large automated network. A methodology is developed by means of which the efficiency of the cycle proprogramming strategy in managing traffic in a large network can be studied. The methodology is then used to analyze the operating conditions on an example automated network for the Detroit area. The system is envisioned as providing control for dual mode vehicles on guideways.

Search terms: Automatic highways; Guideway systems; Automatic traffic control; Traffic management; Traffic volume; Detroit; Dual mode vehicles; Urban traffic flow

HS-011 356 Fld. 2/9

WEAVING SAFETY STUDY. FINAL REPORT

by Z. S. Tashjian; S. E. Charles

University of Southern California, ITTE

1971 51p 6refs

Contract RTA-13945-13742

Report no. UCLA-ENG-7121; PB-201 957

In cooperation with Federal Highway Administration.

This report concerns the application of aerial photographic methods of data acquisition, reduction, and analysis to the behavior of traffic in a weaving section of freeway. The study site is on Route 80, immediately north of the Route 80/99/50 interchange. Aerial photography was carried out at pre-selected times of day, on the basis of ground-based counts. The data were in two groups, "before" and "after." The study was aimed at evaluating the influence of certain physical changes at the site upon the behavior of traffic. Data were reduced into the form of vehicular trajectories. The parameters swerve, trajectory smoothness, queueing,

and velocity were defined and analyzed as functions of flow.

Search terms: Aerial photography; Traffic data analysis; Traffic flow; Weaving; Vehicle trajectories; Data acquisition; Traffic data reduction; Speed patterns; Queueing theory; Environmental factors; Freeway driving; Mathematical analysis; California

AVAILABILITY: NTIS as PB-201 957

3/0 HUMAN FACTORS

3/1 Alcohol

HS-011 357 Fld. 3/1

ALCOHOL IN THE NIGHT: A SUMMARY

by William L. Carlson; Cheryl D. Clark

Published in *HIT LAB Reports* p1-3 (Nov 1971)

The Highway Safety Research Institute conducted a survey in March 1971 of randomly selected nighttime drivers. The survey was part of the evaluation of the Wahstenaw County Alcohol Safety Action Program. Approximately 19% of the drivers were found to have been drinking, and 10% were at or above a level that impairs driving capability. These percentages increased to a peak in the early morning hours. Relationships between personal characteristics and alcohol usage are presented.

Search terms: Alcohol usage; Night driving; Drinking drivers; Driver intoxication; Time of day; Alcohol Safety Action Projects; Blood alcohol levels; Driver characteristics

HS-011 358 Fld. 3/1

WHERE WE STAND ON DRINKING DRIVING LEGISLATION

by Marvin H. Wagner

Published in *Traffic Safety* v72 n1 16-7, 35-6 (Jan 1972)

The current status of laws on implied consent, chemical testing, and quantitative blood alcohol levels is described. Ten suggestions for innovative legislation to help curb drinking drivers are outlined, most of them harsh enough to be controversial. They deal with arrest and sentencing procedures, license revocation or restriction, compulsory treatment for alcoholism, and insurance penalties for convicted drinking drivers.

Search terms: Alcohol chemical tests; Alcohol blood tests; Blood alcohol levels; Implied consent laws; Alcohol laws; Drinking drivers; Driver intoxication; Alcohol usage deterrents; Arrests; Driver prosecution; Driver license revocation; Driver license restrictions; Alcoholism; Driver rehabilitation; Insurance

3/2 Anthropomorphic Data

HS-011 359 Fld. 3/2

DIFFERENCES IN TRACKING SKILL AND PSYCHO- PHYSIOLOGICAL ACTIVATION DYNAMICS IN CHILDREN HIGH OR LOW IN PERSISTENCE IN SCHOOLWORK

by Ingmar Dureman; Ake Palshammar

Published in *Psychophysiology* v7 n1 p95-102 (Jul 1970)

6refs

Seven children rated by their teachers as high in persistence were compared with seven low in persistence in a simulated car driving situation with a risk taking game component. Increased reward was paid for every consecutive two minutes that they managed to drive without making more than five "off the road" errors. More than five errors meant loss

3/2 Anthropomorphic Data (Cont'd.)

HS-011 359 (Cont'd.)

of accumulated reward, and the situation thus was meant to evoke a kind of temporal approach-avoidance conflict. Heart rate, skin conductance, and respiratory rate were recorded throughout. The low persistence children made significantly more "off the road" errors, had lower skin conductance levels and lower respiratory rates, and showed a suggested difference in the pattern of change in skin conductance. All the children were 9 and 10-year-olds.

Search terms: Driving simulation; Children; Risk taking; Driver errors; Accident avoidance; Heart rate; Galvanic skin response; Respiration; Tracking; Psychophysical discrimination; Psychological factors; Behavior

HS-011 360 Fld. 3/2; 5/6

EXPERIMENTAL HUMAN EXPOSURE TO CARBON MON-OXIDE

by Richard D. Stewart; Jack E. Peterson; Edward D. Barrett; Romeo T. Bachand; Michael J. Hosko; Anthony A. Herrmann

Published in *Archives of Environmental Health* v21 p154-64 (Aug 1970)

9refs

Human volunteers were exposed to carbon monoxide at concentrations of 1, 25, 50, 100, 200, 500, and 1,000 ppm for periods of one-half to 24 hours. No untoward effects were observed in sedentary males exposed to 100 ppm for eight hours. Exposures producing carboxyhemoglobin saturations greater than 15% to 20% resulted in delayed headaches, changes in the visual evoked response, and impairment of manual coordination.

Search terms: Carbon monoxide; Carboxyhemoglobinemia; Carboxyhemoglobin; Carbon monoxide poisoning; Vision disorders; Headache;

Motor skills; Males; Blood carbon monoxide levels; Air pollution effect on health

HS-011 361 Fld. 3/2

THE ADULT HUMAN HAND: SOME ANTHROPOMETRIC AND BIOMECHANICAL CONSIDERATIONS

by John W. Garrett

Published in *Human Factors* v13 n2 p117-31 (Apr 1971)

10refs

Recent studies of the anthropometric and biomechanical characteristics of hands are summarized, including: conventional anthropometry of male and female hands; anthropometry of the relaxed hand; comparison of certain engineering anthropometric and performance parameters between bare and pressure-gloved hands; and ability to retain grips on selected handles under high dynamic loads. The utility of these data for human factors engineering is discussed.

Search terms: Anthropometry; Biomechanics; Hands; Grasping strength; Males; Females; Human factors engineering; Handles; Gloves; Load bearing tests; Muscular forces; Nomo-graphs; Hand motion range

3/4 Driver Behavior

HS-011 362 Fld. 3/4

THE YOUNG DRIVER FOLLOW-UP STUDY: AN EVALUATION OF THE ROLE OF HUMAN FACTORS IN THE FIRST FOUR YEARS OF DRIVING

by David M. Harrington

California Dept. of Motor Vehicles

1971 241p

Report no. HRR-38

A sample of 13,915 drivers licensed at ages 16 and 17 was studied. Data studied included driving record, biographical information, accident and conviction records, high school records, questionnaires, and interviews. The average number of accidents showed little change in the first four years of driving. This result does not provide support for increasing the licensing age to 18. The accident rate adjusted for mileage decreased with increasing experience. License suspension and revocation were ineffective in keeping drivers off the road. Citizenship grade in high school was the best predictor of accidents and convictions, but biographical data could not be used to identify accident prone drivers prior to licensing. Those with behind-the-wheel driver training had better driving records, but also more socially desirable personalities, indicating bias. High accident subjects were more reckless, emotional, involved with cars, and characterized by social deviancy.

Search terms: Accident rates; Statistical analysis; Adolescent drivers; Young adult drivers; Accident proneness; Problem drivers; High risk drivers; Risk taking; Driver records; Accident repeater drivers; Questionnaires; Driver interviews; Traffic law violations; Accident risk forecasting; Driver experience; Driver mileage; Driver license suspension; Driver license revocation; High school drivers; Driver personality; Behind the wheel instruction; Sociological factors; Psychological factors; Driver behavior research; Low risk drivers

HS-011 363 Fld. 3/4; 3/8; 4/7

THE EFFECTS OF ENVIRONMENTAL CONDITIONS ON DRIVER ON-RAMP MERGING BEHAVIOR

by Robert G. Carter; E. L. Seguin; R. T. Root; G. B. Avis

HRB-Singer, Inc.

1970 123p 33refs

Contract CPR-11-5934

Report no. TR-4135.11; PB-196 511

Driver merging on urban freeway ramps was studied in terms of perception of the merging situation and the possible differential effects of environmental conditions on gap acceptance or rejection. Photographic recording of actual merging behavior on a ramp on the Long Island Expressway was analyzed in terms of 43 alternative mathematical expressions of gap size used. Among objectives of the research were determination of the most psychologically effective measures of gap size and determination of changes in driver behavior relating to gap size under varying environmental conditions, such as dry and wet weather, day and night driving. Results indicated that those subjective measures of gap size most closely related to merging behavior reflected the kinematics of lag conditions. Time lag also showed a high relationship. Merging behavior differences under various environmental conditions are discussed.

Search terms: Ramps; Merging; Gap acceptance; Environmental factors; Mathematical analysis; Psychological factors; Driver behavior research; Wet road conditions; Dry road conditions; Night driving; Time headways; Headway variances; Freeway driving; Perception; Decision making; Kinematics; Waiting time; Probit analysis; Highway lighting

AVAILABILITY: NTIS as PB-196 511

HS-011 364 Fld. 3/4

THE YOUNG DRIVER FOLLOW-UP STUDY: AN EVALUATION OF THE ROLE OF HUMAN FACTORS IN THE FIRST FOUR YEARS OF DRIVING. AN ABSTRACT

by David M. Harrington

California Dept. of Motor Vehicles

1971 26p

Report no. RR-38

A sample of 13,915 drivers licensed at ages 16 and 17 was studied. Data studied included driving record, biographical information, accident and conviction records, high school records, questionnaires, and interviews. The average number of accidents showed little change in the first four years of driving. This result does not provide support for increasing the licensing age to 18. The accident rate adjusted for mileage decreased with increasing experience. License suspension and revocation were ineffective in keeping drivers off the road. Citizenship grade in high school was the best predictor of accidents and convictions, but biographical data could not be used to identify accident prone drivers prior to licensing. Those with behind-the-wheel driver training had better driving records, but also more socially desirable personalities, indicating bias. High accident subjects were more reckless, emotional, involved with cars, and characterized by social deviancy.

Search terms: Accident rates; Statistical analysis; Adolescent drivers; Young adult drivers; Accident proneness; Problem drivers; High risk drivers; Risk taking; Driver records; Accident repeater drivers; Questionnaires; Driver interviews; Traffic law violations; Accident risk forecasting; Driver experience; Driver mileage; Driver license suspension; Driver license revocation; High school drivers; Driver personality; Behind the wheel instruction; Sociological factors; Psychological factors; Driver behavior research; Low risk drivers

HS-011 365 Fld. 3/4

FIT TO DRIVE? RESEARCH INTO DRIVER BEHAVIOUR

by Stuart Bladon

Published in *Autocar* v135 n3940 p26-7 (30 Sep 1971)

The Road Research Laboratory (England) is studying the relationship between driving and temperament and has identified three categories of non-safe drivers. Injudicious drivers have a high rate of unusual maneuvers and near accidents. Dissociated active drivers are unpredictable and impatient; they also have a high incidence of near accidents. Dissociated passive drivers are patient and stolid but do not have enough appreciation of traffic situations.

Search terms: Driver personality; Accident risk forecasting; Accident proneness; Problem drivers; High risk drivers; Risk taking; Driver behavior research; Psychological factors

HS-011 366 Fld. 3/4

BEHAVIORAL PATTERNS OF SNOWMOBILE OPERATORS—A PRELIMINARY REPORT

by William L. Carlson; David Klein

Published in *Journal of Safety Research* v3 n4 p150-6 (Dec 1971)

8refs

The traffic records of snowmobile owners who had and who had not reported at least one snowmobile crash were compared with those of the general driving population and a control group. Crash-involved snowmobile owners had significantly more traffic convictions and vehicle crashes than the other groups. Snowmobile owners without reported crashes had traffic records that were better than those of the crash participants but worse than those of the controls, and their traffic records apparently became worse after the acquisition of the snowmobile. No difference was found among the groups in size or horsepower of automobile.

Search terms: Snowmobile operators; Snowmobile accidents; Driver behavior research; Accident repeater drivers; Traffic law violators; Driver records; Problem drivers

3/5 Driver Education

HS-011 367 Fld. 3/5

A RESOURCE CURRICULUM IN DRIVER AND TRAFFIC SAFETY EDUCATION

Automotive Safety Foundation

1970 180p 107refs

This curriculum manual for driver education courses is based on a number of major concepts dealing with the nature of driver and traffic safety education; the systems approach; tasks as focal points; the identification of human functions in driving; behavioral objectives; the communication of fundamental concepts to students; the challenge to teachers; discovery versus telling; the efficient use of classroom and laboratory time; and the motivation of students to continue learning.

Search terms: Driver education manuals; Curricula; Safety education; Instruction materials; Driving tasks; Systems analysis; Human factors; Driver behavior; Learning rates

3/8 Environmental Effects

HS-011 368 Fld. 3/8

NOISE ANNOYS WHO? WHEN? WHY?

by Glenn Jones; William J. Galloway

Published in *Concepts* v4 n3 p1-6 (Fall-Winter 1971)

A survey was conducted to evaluate annoyance caused by differing types of vehicles. Adults in three cities were interviewed. Although nearly 80% thought that motor vehicles contributed to the noisiness of their neighborhoods, only 44% were irritated by this, and only 16% were disturbed by motor vehicle noise at all. Loudness and annoyance perceived differ for various noise sources and types of vehicles—buses, motor-

cycles, diesel trucks, autos, gasoline trucks, free flowing traffic, tire squeal, exhaust, reckless driving, sirens, engine and transmission rattle, horns. Annoyance tends to increase with education, affluence, and occupational status. It is not so much the sound of vehicles at work that is annoying as it is the sound of vehicles being misused.

Search terms: Noise exposure; Noise tolerances; Vehicle noise; Traffic noise; Sociological factors; Engine noise

3/12 Vision

HS-011 369 Fld. 3/12; 5/10

VISIBLE DISTANCES IN NIGHT DRIVING OPPOSING MIS-ALIGNED DIPPED HEADLIGHTS

by Kare Rumar

Published in *Zeitschrift fur Verkehrssicherheit* v14 n2 p111-5 (1968)

15refs

Tests were made to determine how the visibility distance of drivers meeting another car changes with vertical adjustment of the headlights of the oncoming car. The opposing car with easily adjustable headlights in the vertical direction was stationary. Subjects drove the other car with correctly adjusted headlights. The headlight adjustment of the stationary car was varied from 2 degrees too low to 5 degrees too high. The result was that, compared to correctly adjusted meeting lights, the visibility distance was not increased by a downward misalignment of opposing headlights. On the other hand, an upward misalignment of 1-2 degrees of opposing headlights decreased the normal visible distance by about 25%.

Search terms: Night visibility; Night driving; Night vision; Oncoming vehicles; Sight distances; Reduced visibility; Headlamp alignment; Low beamed headlamps; High beamed headlamps

4/0 OTHER SAFETY-RELATED AREAS

4/2 Community Support

HS-011 370 Fld. 4/2

SURVIVAL '71: YOUTH ON THE HIGHWAYS

by Karen Yengich

Published in *Concepts* v4 n3 p7-14 (Fall-Winter 1971)

YOUTHS (Youth Order United Toward Highway Safety) was formed in January 1971 in an effort to direct the energy of young people to a national highway safety crusade. Some aspects discussed at their first conference were crash survival, especially the use of air bags; alcohol and drugs; driver education; auto theft. The young people attending the conference felt that present highway safety programs are not aggressive enough.

Search terms: Adolescents; Young adults; Accident survivability; Alcohol usage deterrents; Drinking drivers; Drug addiction; Driver education; Stolen vehicles; Community support; Highway safety programs; Air bag restraint systems

4/4 Governmental Aspects

HS-011 371 Fld. 4/4

MANAGEMENT FOR ACCIDENT CONTROL

by William E. Tarrants

National Hwy. Traf. Safety Administration

Published in *ASSE Journal* v17 n2 p8-15 (Feb 1972)

32refs

Great changes are taking place in the methods of management for accident control. Dr. Tarrants discusses these and

how they relate to safety professionals. Management will be looking to the latter more and more as individuals who can step far enough back from day-to-day operations to take an objective view of the entire system by which an organization is run rather than as simply as specialist intent on examining the safety aspects alone. The safety professional's concern with before-the-fact problem analysis, his contributions to product development, and his use of more objective techniques of systems performance appraisal will make him a valuable member of the management team.

Search terms: Flow charts; Highway safety organization management; Safety programs; Accident prevention; Personnel management; Manpower utilization; Systems analysis; Problem solving; Decision making

4/5 Information Technology

HS-011 372 Fld. 4/5; 5/18; 5/1; 3/4

AUTOMOBILE DYNAMICS: A COMPUTER SIMULATION OF THREE-DIMENSIONAL MOTIONS FOR USE IN STUDIES OF BRAKING SYSTEMS AND OF THE DRIVING TASK. INTERIM TECHNICAL REPORT

by Raymond R. McHenry; Norman J. DeLeys

Cornell Aeronautical Lab., Inc.

1970 218p 15refs

Contract CPR-11-3988

Report no. CAL-VJ-2251-V-7; PB-196 991

A computer simulation of complex, three-dimensional dynamics of automobiles on irregular terrain is described, which is suitable for studies related to the performance of vehicle braking systems and to the driving task, including the upper limits of control as well as the linear ranges of operation. The reported simulation is a specialized version of an earlier analytical develop-

ment. Sprung mass impact aspects of the earlier simulation have been removed, and a number of refinements and extensions of the analytical treatments of tire forces, suspension properties, and terrain definitions have been incorporated. Analytical representations of the braking system and the drive line and approximations of rolling resistance and aerodynamic drag have been introduced. Sample outputs of the modified computer program are presented and discussed. The mathematical model is described, and the detailed analysis, equations, and logic are presented.

Search terms: Vehicle dynamics; Driving task analysis; Brake systems; Vehicle control; Computerized simulation; Tire forces; Topographical factors; Ground roughness; Drivelines; Drag; Computer programs; Mathematical models; Tire loads; Tire rolling resistance; Tire side forces; Tire slip motion; Wet road conditions; Coefficient of friction; Equations of motion; Torque

AVAILABILITY: NTIS as PB-196 991

HS-011 373 Fld. 4/5; 4/2

THE DISTRIBUTION OF FEDERAL "402" HIGHWAY SAFETY PROJECTS

by John A. Green; Haldon L. Smith

Published in *HIT LAB Reports* p5-8 (Nov 1971)

The Countermeasures Data File, one of several special purpose files maintained by the Highway Safety Research Institute, is discussed and some of the information derivable from it is presented. To encourage compliance with the 16 highway safety standards, federal funds were made available to the states on a 50-50 matching basis under Section 402 of the Highway Safety Act of 1966. As of July 30, 1970, data indicate that over 4,000 state and community highway safety projects have been funded by the National Highway Traffic Safety Admin-

istration, with traffic records, driver education, and police traffic services accounting for over half of the funds authorized and the projects carried out.

Search terms: Computerized records management; Information systems; Highway safety standards; Safety standards compliance; Highway Safety Act of 1966; Community support; State planning; Traffic records; Driver education; Police traffic services; Highway safety programs; Federal aid; Grants

HS-011 374 Fld. 4/5; 1/3

THE CHICAGO ACCIDENT INFORMATION SYSTEM

by Robert B. Dial

Published in *Traffic Engineering* v42 n4 p38-41, 52 (Jan 1972)

2refs

A computerized accident information storage and retrieval system is described. The data base encompasses a four-year accident history contained in four types of files: accident detail; location; street; and summary.

Search terms: Information systems; Information retrieval; Accident records; Accident location; Chicago; Automated accident records; Electronic accident analysis

4/7 Mathematical Sciences

HS-011 375 Fld. 4/7; 5/22

A MATHEMATICAL ANALYSIS OF HYDROPLANING PHENOMENA. TECHNICAL REPORT. FINAL REPORT.

by H. Daughaday, C. Tung

Cornell Aeronautical Lab., Inc.

1969 156p 38refs

Contract FH-11-6659

Report no. CAL-AG-2495-S-1; PB-182 633

4/7 Mathematical Sciences (Cont'd.)**HS-011 375 (Cont'd.)**

A mathematical analysis is developed for predicting phenomena encountered when a tire rolls or skids on a pavement covered with a water film. Partial hydroplaning is considered where part of the normal force on the tire is carried by dry contact between the tire and the pavement and also the onset of total hydroplaning, where the tire first becomes entirely supported by hydrodynamic pressures. The flow is divided into a footprint region, an inlet region forward of the footprint region where the gap between the tire and the pavement is comparatively large, and an exterior flow region, and perturbation analysis is used. Differences between partial and complete hydroplaning are described mathematically.

Search terms: Mathematical analysis; Hydroplaning; Wet road conditions; Tire rolling resistance; Tire road contact forces; Tire prints; Tire pavement interface; Coefficient of friction; Friction studies; Pavement friction; Hydrodynamics; Wet skidding; Perturbation; Drainage; Tire treads; Mathematical models; Water depth

AVAILABILITY: NTIS as PB-182 633

5/0 VEHICLE SAFETY**5/1 Brake Systems****HS-011 376 Fld. 5/1****CORROSION-RESISTANT, HIGH-STRENGTH CLAD METAL SYSTEM FOR HYDRAULIC BRAKE LINE TUBING**

by Robert Baboian

Texas Instruments, Inc.

1972 17p 33refs
Report no. SAE-720290

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

A new clad metal system has been developed as a material for hydraulic brake line tubing. The material consists of a 1008 LCS/304 SS/1008 LCS composite in the ratio 45%/10%/45%. Laboratory experimental tests, accelerated life tests, and field tests were performed on brake tubing formed from this material. The results show that the brazed and ternecoat low-carbon steel/stainless steel/low-carbon steel tubing has excellent corrosion resistance and high mechanical strength. The results are compared with those obtained with conventional brazed and ternecoat LCS brake tubing.

Search terms: Brake lining materials; Brake lining tests; Brake lining wear; Materials tests; Laboratory tests; Field tests; Composite materials; Carbon steels; Stainless steels; Corrosion resistance; Strength (mechanics); Tubes; Hydraulic brakes; Metal working; Mechanical properties; Corrosion tests; Life tests

AVAILABILITY: SAE

HS-011 377 Fld. 5/1**REAR DISC BRAKE SOLVES PARKING ACTUATION PROBLEMS**

by William Flanagan; Jack Turak; Jim Low; Richard Bumett

Published in *Automotive Engineering* v80 n1 p64-7 (Jan 1972)

One of the problems with rear disc brakes is how to apply the parking brake. Two different caliper assemblies have been developed to apply the service pads to the service rotor for parking. A compensated adjuster keeps close tolerances so an actuator with high mechanical advantage can apply a large caliper clamping force with low operator effort.

Search terms: Actuators; Disc brakes; Parking brakes; Coefficient of friction; Braking forces; Toggle switches

5/4 Design**HS-011 378 Fld. 5/4; 4/7****AN ANALYSIS OF AUTOMATIC TRANSMISSION CLUTCH-PLATE TEMPERATURES**

by K. Tataiah

Shell Oil Co.

1972 9p 4refs
Report no. SAE-720287

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Automatic transmission clutch failures and rapid oxidation of the transmission fluid have sometimes been attributed to high temperatures in the clutch pack. For the purpose of estimating these temperatures, an analysis was made of the clutch system, and a solution was developed from the partial differential equations of heat conduction with appropriate boundary conditions. The solution thus obtained was verified experimentally. There were several important conclusions to this study. The maximum temperature rise occurs somewhat earlier than the end of the lockup time. The interface temperature rise increases as the lockup time decreases for a fixed amount of energy input. The ratio of heat flux entering the reaction plate to that entering the composite plate is not constant, as has been assumed by others. The heat absorbed by the fluid outside the clutch pack is negligible during the short lockup time. Temperatures rises for some typical cases are computed.

Search terms: Clutch failures; Transmission fluids; High temperature; Operating temperature; Thermal conductivity; Heat flux; Heat absorption; Clutch plates; Automatic transmissions; Boundary layer; Time factors; Mathematical analysis

AVAILABILITY: SAE

HS-011 379 Fld. 5/4

THE DEVELOPMENT OF AUTO TEMP II

by R. B. Caldwell; R. F. Johnson; R. A. Simon

Ranco, Inc.; Chrysler Corp.

1972 12p

Report no. SAE-720288

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

The development of the AUTO TEMP II Temperature Control System used in Chrysler Corp. vehicles is summarized. A description of the design, development, function, and manufacturing aspects of the control system is presented, with emphasis on unique control parameters, reliability, serviceability, and check-out of production assemblies. Auto Temp II was developed by Chrysler in conjunction with Ranco Incorporated. The servo-controlled, closed-loop system, which has a sensitivity of 0.5 F, utilizes a water-flow control valve for temperature control, along with a cold engine lock-out. The basic components are: sensor string, servo, and amplifier. All automatic functions involving control of mass flow rate, temperature, and distribution of the air entering the vehicle, are encompassed in one control unit. All components are mechanically linked through the gear train and are responsive to the amplifier through the feedback potentiometer.

Search terms: Air conditioning; Interior climate control systems; Controlled air environment systems; Cooling systems; Air flow; Amplification; Potentiometers; Servomechanisms; Sensors

AVAILABILITY: SAE

HS-011 380 Fld. 5/4

FORMED-IN-PLACE RTV SILICONE GASKETS

by W. A. Maudlin

Dow Corning Corp.

1972 8p 9refs

Report no. SAE-720291

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

The formed-in-place gasket concept consists of using a paste-type liquid silicone RTV (room temperature vulcanizing rubber) applied to the flange area of the components to be sealed and having the flanges squeeze out and form the liquid gasket on assembly. This system offers several advantages over the conventional precut or preformed gaskets. This system can replace all the static gaskets on a drive train (except head and manifold) and perform as well or better than the gaskets it replaces. Material cost can be reduced as can handling costs when the RTV is automatically applied.

Search terms: Gaskets; Drivetrains; Silicone rubbers; Vulcanizing; Sealers

AVAILABILITY: SAE

HS-011 381 Fld. 5/4

CONSIDERATIONS IN THE SELECTION OF MATERIALS FOR MINIATURIZED AUTOMOTIVE TERMINALS AND CONNECTORS

by S. H. Butt

Olin Corp.

1972 11p 1ref

Report no. SAE-720292

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Miniaturization of terminals, connectors, springs, and other contacts in automotive electric systems has imposed rigorous demands upon the principal materials used in their manufacture—copper alloys. This paper surveys the more important copper alloys and presents available data, including that

from current research, which bear upon the problem of material selection. Various coppers, copper alloys, and groups of copper alloys are described, and a brief description of mechanical and electrical properties, corrosion performance, surface characteristics and economics is presented. Comparative data for the various representative copper alloy groups are also presented. Such data includes comparison of mechanical strength—ultimate tensile, offset yield, and fatigue strengths, modulus of elasticity, corrosion resistance—general, stress, and crevice corrosion, dezincification; and surface characteristics—contact resistance, solderability, plating performance. Study of the data indicates that there is no simple optimum choice for all applications. The designer and user should use the data as a guide in selection of materials for each application.

Search terms: Electric system design; Miniaturization; Copper alloys; Mechanical properties; Electric properties; Strength (mechanics); Tensile strength; Fatigue tests; Modulus of elasticity; Corrosion resistance; Dezincification; Concentration cell corrosion prevention; Stress corrosion prevention; Terminals; Connectors

AVAILABILITY: SAE

HS-011 382 Fld. 5/4

RECENT TEST DATA ON SELECTION OF ALLOY STEELS FOR GEARS AND BEARINGS

by J. R. Eagan; C. H. Shelton

1972 10p 8refs

Report no. SAE-720301

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Recent information on the impact and pitting resistance properties of carburized steels is discussed. Quantitative data on the effect of alloys, heat treatment, and mechanical processing provide assistance to the gear and bearing designer in the more efficient utilization of materials.

5/4 Design (Cont'd.)

HS-011 382 (Cont'd.)

Search terms: Steels; Alloys; Steel making; Gears; Bearing materials; Heat treatment; Carburizing; Materials tests; Metal working; Fatigue tests; Laboratory tests; Impact tolerances; Pitting

AVAILABILITY: SAE

HS-011 383 Fld. 5/4

AN ENERGY-ABSORBING SEAT DESIGN FOR LIGHT AIRCRAFT

by B. Underhill; B. McCullough

Piper Aircraft Corp.

1972 11p 5refs

Report no. SAE-720322

Presented at National Business Aircraft Meeting, Wichita, 15-17 Mar 1972.

Aircraft seats that merely hold the occupants rigidly in place have been satisfactory when considering horizontal or lateral decelerations; but they have not proved sufficient when accidents occur resulting in large vertical deceleration. This deficiency led to the concept of an energy-absorbing seat, which would utilize the space between the seat bottom and the floor to absorb impact energy and reduce accelerations, thereby increasing occupant survival potential. To establish the seat design strength requirements, a maximum tolerable "g" load was chosen, and the maximum vertical velocity was calculated based on the available arresting distance. The effect of varying passenger weight was investigated, and a weight was chosen for design purposes. This then defined the load-deflection requirements of the seat. Other requirements established that weight and cost be kept to a minimum and that conventional materials and fabrication processes be used. The development and static and dynamic testing leading to the final design of a lightweight, economical, energy-absorbing seat are described.

Search terms: Seat design; Aircraft safety; Energy absorbing seats; Load bearing capacity; Static tests; Dynamic tests; Load bearing tests; Seat tests; Deceleration tolerances; Human acceleration tolerances; Human body weight; Mathematical models

AVAILABILITY: SAE

HS-011 384 Fld. 5/4

THE DAISY DECELERATOR

by Richard F. Chandler

Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.

1967 67p 34refs

Report no. ARL-TR-67-3; AD-653 972

The Daisy Decelerator is a sled-track facility used for biodynamic and equipment testing. It can produce an impact force capability up to 200,000 pounds (equivalent to 200 G for 1,000 lb. total weight), a maximum impact velocity of 175 ft./sec., and a maximum displacement during impact of 4 ft. Test sleds are available to carry one to three 250 lb. test subjects in a variety of orientations relative to the impact force vector. These sleds are capable of accepting other payloads through simple adaptors. The propulsion and braking equipment of the sled are described. Tests have demonstrated velocity reproduced with a standard deviation of 1.6% and deceleration reproduced with a standard deviation of 3.5%.

Search terms: Impact sleds; Impact tests; Impact forces; Deceleration tolerances; Errors; Accuracy; Test tracks; Test volunteers

AVAILABILITY: NTIS as AD-653 972

HS-011 385 Fld. 5/4

MOTOR NEWS AROUND THE WORLD. DETROIT

by Tony Grey

Published in *Road Test* v8 n3 p5, 8, 10, 12-3, 90 (Mar 1972)

Various developments in the auto industry are briefly described, including: radical changes in headlamps; a new anti-theft ignition switch; research into the development of an atomic fusion reactor fueled by water for powering cars; additional options for the Ford Pinto; hood design and engine size problems; Wankel engines; front wheel drive sub-compact cars.

Search terms: Headlamp design; Ignition locks; Nuclear energy; Reactors; Propulsion systems; Wankel engines; Compact automobiles; Hoods; Engine size; Front wheel drive automobiles; Pinto; Theft prevention devices

HS-011 386 Fld. 5/4

USE OF COLOR PHOTOGRAPHY IN AUTOMOTIVE SAFETY RESEARCH

by C. F. Thelin; R. G. Matthies

Published in *Society of Photo-Optical Instrumentation Engineers Journal* p2-8 (May 1971)

Automobile crash testing produces three kinds of data: post impact deformation trans-impact forces, and trans-impact motions. High speed color movies taken both inside and outside the test car provide the most useful record of the benefit of safety improvements. Cornell Aeronautical Laboratory, Inc. acquires imagery taken from almost every angle during tests which are conducted on an average of once a week of vehicles impacting a concrete barrier, a pole, or another car.

Search terms: High speed photography; High speed impact tests; Barrier collision tests; Pole impact tests; Vehicle vehicle impact tests; Deformation analysis; Impact forces; Motion pictures; Safety research; Photographic equipment

HS-011 387 Fld. 5/4

TRANSMISSIONS

by John Fenton

Published in *Automotive Design Engineering* v10 p19, 21, 23, 25, 27 (Dec 1971)

11 refs

Technological advances in automotive transmissions are described. Aspects included are speculation on manual gearbox development; synchromesh for heavy truck gearboxes; final drive gear design; transmission hardware developments; clutches and control mechanisms; centrifugal clutches for vehicles; chain drive for cars; shunt hydrostatic transmissions; transmissions for gas turbines; variable input power feature on Allison torque converters; and electric drive systems. The article summarizes presentations at the 1970 spring conference of the Institution of Mechanical Engineers.

Search terms: Transmissions; Synchromesh transmissions; Gear boxes; Drive systems; Electric drive systems; Clutches; Gas turbine engines; Torque converters; Hydrostatic transmissions

HS-011 388 Fld. 5/4

DOT'S EXPERIMENTAL SAFETY VEHICLES

by A. B. Shuman

Published in *Analogy* n11 p12-9 (1971)

(an Allstate Ins. Co. publication)

Four safety cars will be subjected to a series of non-destructive and destructive tests to determine which design best meets crashworthiness criteria. The characteristics of the prototype safety cars and their occupants protection systems are described.

Search terms: Safety cars; Experimental vehicles; Crashworthiness; Occupant protection; Nondestructive tests; Automobile tests; Performance characteristics

HS-011 389 Fld. 5/4

THE VEHICLE AND CRASH SURVIVABILITY

by Franklin M. Kreml

Published in *Analogy* n11 p12-9 (1971)

(an Allstate Ins. Co. publication)

Impact sleds and barriers are used to study all kinds of crash situations. From this research have come improvements in vehicle crashworthiness which have made cars safer. The problem of failure to use seat belts and shoulder harnesses remains. An estimated 75% of fatal crashes occur at speeds of less than 60 mph. These crashes should be survivable for occupants wearing their restraint systems.

Search terms: Restraint system usage; Seat belt usage; Shoulder harness usage; Accident survivability; Crashworthy bodies; Impact sleds; Barrier collision tests; Impact tests

HS-011 390 Fld. 5/4

CAR SEATING. A SUITABLE CASE FOR TREATMENT

by Anthony Scott

Published in *Motor* (London) n3626 p6-8 (1 Jan 1972)

Some 70 custom seat designs are available in Britain and are popular with people who spend a great deal of time driving. The characteristics of a number of them are described.

Search terms: Seat designs; Custom automobiles; Great Britain

5/6 Fuel Systems

HS-011 391 Fld. 5/6

AUTOMOTIVE EMISSIONS. A TECHNOLOGY ASSESSMENT METHODOLOGY. VOL. 2

bv Willis E. Jacobsen

MITRE Corp.

1971 207p 62 refs

Contract 26

Report no. MTR-6009; PB-202 778-02

In cooperation with the Office of Science and Technology, Executive Office of the President.

This pilot study on automotive emission control is one in a series of five, each addressing different technologies, prepared as part of the MITRE Technology Assessment Methodology Task for the Office of Science and Technology. A framework for appraising societal influences of control strategies (technological and non-technological) for reducing noxious automotive emissions is developed and illustrative examples, based on a proposed cost/benefit model, are presented.

Search terms: State of the art studies; Benefit cost analysis; Emission control; Sociological factors; Air pollution effect on health; Air quality standards; Air pollution monitoring; Propulsion systems; Internal combustion engines; Public transportation; Automotive industry; Economic analysis; Automobile cultural role; Electric vehicles; Air pollution control costs; Vehicle air pollution; Air pollution emission factors; Air pollutant identification; Environmental planning; Hydrocarbons; Nitrogen oxides; Carbon monoxide; Industrial air pollution; Emission standards; Hybrid engines; Travel patterns; Modal choice

AVAILABILITY: NTIS as PB-202 778-02

HS-011 392 Fld. 5/6

FUEL ADDITIVES AND AUTOMOBILE EXHAUST EMISSIONS

by R. D. Fleming; W. F. Marshall; J. R. Allsup

Bureau of Mines, Bartlesville, Okla.

1971 15p 7refs

Report no. PB-203 894; TRP-40

The influence of fuel additives on exhaust emissions of current automobile models was studied. The fuel additives used were four multifunctional additives and one lead antiknock additive. Both the direct effect of the additives on exhaust emissions and the influence of long-term additive effects on emissions with mileage accumulation were studied. Results showed no significant direct or intermediate effect on exhaust emissions for any additives tested. In studies of the long-term or indirect effects of additives, the detergent-dispersant additives were found to have little influence on emissions when used in conjunction with high quality oil and motor fuel. The tetraethyl lead antiknock additive increased exhaust hydrocarbons about 12-17% during a 4,000 mile test using a base fuel with 2 ml tetraethyl lead per gallon. An unleaded fuel was used in another test with no significant increase in exhaust hydrocarbons with mileage.

Search terms: Fuel additives; Exhaust emissions; Vehicle mileage; Tetraethyl lead; Knock; Lead free gasoline; Leaded gasoline; Hydrocarbons; Exhaust emissions measurement

AVAILABILITY: NTIS as PB-203 894

HS-011 393 Fld. 5/6

MOBILE TEST VEHICLE MEASURES EXHAUST EMISSIONS ON THE ROAD

by W. I. Doty; L. J. Olejnik

Published in *Automotive Engineering* v80 n1 p68-72 (Jan 1972)

The acquisition of meaningful performance and exhaust emission data from automobiles under actual road conditions is vital to valid laboratory results. Such data are now being obtained with a mobile instrumented car. Tests were run at idle-drive, at steady speeds on the chassis dynamometer, and at steady speeds on the road. In general, test results show that engine tuneup parameters can have a major influence on vehicle exhaust emissions and fuel economy.

Search terms: Exhaust emission tests; Engine operating conditions; Laboratory tests; Road tests; Instrumented vehicles; Fuel economy; Tuneup; Chassis dynamometers; Engine speeds

5/10 Lighting Systems

HS-011 394 Fld. 5/10

FIELD ADJUSTMENT AND INSPECTION OF HEADLAMP AIM

by D. Walker

Ford Motor Co.

1972 34p

Report no. SAE-720286

Presented at Automotive Engineering Congress, Detroit, 10-14 Jan 1972.

Adjustment and inspection of headlamp aim may be accomplished by four methods: visual, optical, photoelectric, and mechanical. Visual aim is the simplest but the least accurate. There are problems with an optical aimer also. Two photoelectric aim systems are available. The field photoelectric aimer lacks the required precision and accuracy for aim adjustment and inspection. The "third derivative" photoelectric aim system is accurate and precise but very expensive. However, mechanically aimable lamps can be aimed and inspected with mechanical aimers, which are less expensive and more adaptable to field or shop aim adjustment or inspection. When used with mechanically aimable lamps, mechanical aimers are

more accurate than visual, optical, or photoelectric systems and should be used for aim adjustment and inspection in the field as well as for service.

Search terms: Headlamp aiming; Photoelectric cells; Inspection equipment; Optical detectors; Visual perception; Field tests; Mathematical analysis; Errors; Accuracy

AVAILABILITY: SAE

5/11 Maintenance and Repairs

HS-011 395 Fld. 5/11

TESTIMONY OF WILLIAM HADDON, JR., M.D. PRESIDENT, INSURANCE INSTITUTE FOR HIGHWAY SAFETY, BEFORE THE SENATE COMMITTEE ON COMMERCE, MAY 12, 1971

by William Haddon, Jr.

Insurance Inst. for Hwy. Safety

1971 33p 10refs

Impact tests of 12 1971 model cars at 10 and 15 mph are described. The repair costs for small, medium sized, and standard cars are given. Repair costs for the 1971 cars are considerably higher than for 1970 cars, chiefly because of the increased costs of replacement parts and the fragility of the cars. The federal standard for rear bumpers, which will go into effect with the 1973 model year, is criticized for inadequacy.

Search terms: Bumper standards; Low speed impact tests; Crashworthy bodies; Energy absorbing front structures; Energy absorbing rear structures; Damage severity; Damage costs; Automobile repair costs

5/14 Occupant Protection

HS-011 396 Fld. 5/14

DYNAMIC TESTS OF GENERAL AVIATION OCCUPANT RESTRAINT SYSTEMS

by Hector Danutolo

Federal Aviation Administration

1972 73p 6refs
Report no. SAE-720325

Presented at National Business Aircraft Meeting, Wichita, 15-17 Mar 1972.

A series of twenty-two dynamic tests was conducted on general aviation occupant restraint systems. These tests utilized lap belt and lap belt/shoulder harness restraint systems. The Federal Aviation Regulations require only lap belt restraint systems for emergency landing conditions. Based on the longitudinal deceleration/time response of anthropomorphic dummy occupants, it was demonstrated that the lap belt/shoulder harness restraint systems offered occupants successful restraint at occupant inertia force levels substantially above the current regulatory level. The tests, preliminary in nature, warranted continuation of the test program. The lap belt/shoulder harness restraint systems showed promise for regulatory inclusion by virtue of the fact that results were achieved with restraint systems offered as options in recent years, requiring minimal weight increase with fuselage reinforcement adaptable to retrofit as well as new assembly.

Search terms: Restraint system tests; Dynamic tests; Seat belt tests; Shoulder harnesses; Anthropomorphic dummies; Occupant protection; Aircraft safety; Deceleration tolerances; Impact sleds; Crashworthy bodies

AVAILABILITY: SAE

HS-011 397 Fld. 5/14

AIRCRAFT FIRE PROTECTION TECHNOLOGY APPLICATIONS

by J. G. Alexander; J. H. Newland; D. M. Patterson; F. L. Tempesta

AVCO Corp.

1972 6p 2refs
Report no. SAE-720345

Presented at National Business Aircraft Meeting, Wichita, 15-17 Mar 1972.

A different approach to aircraft passenger survival has been undertaken by the National Aeronautics and Space Administration and AVCO Corporation—that of shielding the passenger compartment by surrounding it with a fire resistant foam shell capable of protecting the occupants long enough for the fire to burn out, or for fire-fighting equipment to reach the aircraft and extinguish the fire. Application of the newly evolved intumescent material as a passive thermal control system to provide fire protection for remote or inaccessible dry bay regions and equipment bays is also discussed.

Search terms: Aircraft safety, Occupant protection; Accident survivability; Flame retardants; Structural foams; Passenger compartments; Flame barriers; Fire resistant materials; Fire fighting; Fire resistant coatings; Thermal factors

AVAILABILITY: SAE

HS-011 398 Fld. 5/14

COMING SOON: PASSIVE RESTRAINTS

by H. R. Whitaker

Published in *Analogy* n11 p21-5 (1971)

(an Allstate Ins. Co. publication)

Although ejection from a vehicle during a crash increases chances of fatal injury by 500%, a great many people will not use their seat belts. Passive restraints are considered necessary because less than a third of motorists use their seat belts and less than 5% use their shoulder harnesses. Various types of passive restraints are described, especially the air bag. Beginning with 1976 model cars, auto makers will be required to use some kind of passive restraint system.

Search terms: Passive restraint systems; Air bag restraint systems; Seat belt usage; Shoulder harness usage;

Occupant protection; Accident survivability; Ejection caused injuries

HS-011 399 Fld. 5/14

ARE YOU SITTING SAFELY? WE TEST SOME WELL-USED SEAT BELTS

by Tony Kyd

Published in *Motor* (London) n3626 p9-11 (1 Jan 1972)

Five worn seat belts were removed from cars and subjected to the strength of assembly test which is required for new belts in Britain. None of the belts failed the test. It is recommended, however, that belts should be replaced when a considerable amount of fabric furring due to abrasion is showing. Specifications for child safety seats call for even more complex tests than do specifications for adult safety belts. Designs and performance of several child safety seats and harnesses are described.

Search terms: Seat belt tests; Performance tests; Child safety seats; Child seat belts; Wear tests

5/18 Steering Control System

HS-011 400 Fld. 5/18; 4/7

VEHICLE ROLL AND JACKING EFFECTS

by P. J. Milner

Published in *Automobile Engineer* v62 n1 p18-21 (Jan 1972)

The characteristics of different types of suspension are illustrated mathematically and the theory extended to determine frequencies of oscillation. Mathematical models are given for lateral acceleration, roll angle, jacking, and oscillation frequency.

Search terms: Suspension systems; Mathematical models; Lateral acceleration; Roll; Jacking; Oscillation; Steady state; Equations of motion

5/20 Trucks and Trailers

HS-011 401 Fld. 5/20; 5/14; 5/18

TRACTOR OPERATION AND ROLL-OVER PROTECTIVE STRUCTURES

National Safety Council

Published in *National Safety News* v105 n2 p83-7 (Feb 1972)

6refs.
Report no. Data-Sheet-622

About half of fatal tractor accidents involve overturning. The hazards inherent in tractor operation are discussed. Misuse of tractors also contributes to overturning accidents. Protective devices for all types of tractors are described, including protective frames and safety belts. Operating safety precautions are also discussed.

Search terms: Rollover accidents; Rollover protective structures; Tractor design; Vehicle stability; Occupant protection; Safety belts

HS-011 402 Fld. 5/20

THE SNOWMOBILE IS AN AMERICAN DREAM MACHINE

by Berkeley Rice

Published in *New York Times Magazine* p14-5, 26, 28, 30, 32-3 (13 Feb 1972)

The popularity of the snowmobile has resulted in a revolution in winter recreation. There are now about two million snowmobiles, and they have become major economic factors in northern communities. There are about 3,000 snowmobile clubs. The costs of owning and operating snowmobiles are described. The problems of snowmobiling include mechanical breakdowns, accidents, operation by children, noise, environmental damage, and trespassing.

Search terms: Snowmobiles; Snowmobile accidents; Winter driving; Children; Noise; Environmental factors; Vehicle operating costs; Legal factors; Recreational driving; Failures

5/22 Wheel Systems

HS-011 403 Fld. 5/22; 1/3; 2/4

RELATIONSHIP OF THE TIRE-PAVEMENT INTERFACE TO TRAFFIC ACCIDENTS OCCURRING UNDER WET CONDITIONS. RESEARCH REPORT FOR A PILOT STUDY TO DETERMINE THE DEGREE OF INFLUENCE OF VARIOUS FACTORS PERTAINING TO THE VEHICLE AND THE PAVEMENT ON TRAFFIC ACCIDENTS UNDER WET CONDITIONS

by Elmore H. Dean

Texas Hwy. Dept.

1969 139p 28refs
Report no. RR-133-1

In cooperation with Bureau of Public Roads. (Master's thesis.)

Information was collected on accident-involved vehicles and sites pertaining to tire pressure on all tires; tire tread depth on all tires; other tire characteristics; friction at the site and within half a mile; and other accident factors. It was found that the wet weather accident rate was nearly double the rate for other conditions and that the pavement was wet 6.7% of the time period studied (five months). While all tire factors are probably important in driving on wet pavement, it was found that lack of tread depth on the rear tires was of major importance in the accidents studied, especially the skidding accidents. It is believed that a change in coefficient of friction near the accident sites has a small effect on wet weather accidents. A significant difference was found between a sample average of friction values and those at the accident sites.

Search terms: Pavement skidding characteristics; Pavement surface texture; Pavement skid resistance; Accident location; Wet road conditions; Wet skidding; Skidding accidents; Accident rates; Accident studies; Tire-pavement interface; Tire tread depths; Tire inflation pressure; Tire characteristics; Accident factors; Environmental factors; Rear tires; Coefficient of friction; Friction studies; Accident statistics

HS-011 404 Fld. 5/22

TALKING ABOUT TIRES

by Dick Cross

Published in *Commercial Car Journal* v122 n5 p69-76 (Jan 1972)

Tire cost control for vehicle fleets is discussed. Advantages of tube-type, tubeless, radial, and special purpose tires are described. Tire recapping procedures are outlined. Fleets need a program for tire inspection and maintenance and should keep proper records to determine what their problems are.

Search terms: Truck tires; Tubeless tires; Fleet management; Radial tires; Tire characteristics; Tire performance; Tire maintenance; Tire inspection

HS-011 405 Fld. 5/22

IF WINTER COMES . . .

by J. McLellan

Published in *Rubber Developments* v24 n3 p77-80 (1971)

5refs

Studded tires are under heavy criticism for the damage they inflict on road surfaces. They have been banned in Ontario and several states. The development of studless winter tires using oil extended natural rubber tread mixes is described. Tests were made with these tires on a frozen lake, on glare ice, and

on snow. The tests showed that on surfaces representing 98% of winter driving conditions, tires without studs performed as well or even better than studded tires.

Search terms: Performance tests; Tire treads; Studded tires; Pavement damage; Tire materials; Rubber compounds; Winter driving; Tire tests; Tire performance; Wet road conditions; Tire traction; Icy road conditions; Cold weather tests; Vehicle snow interface

HS-011 406 Fld. 5/22

STUDIES ON TIRE WEAR. I. CORRELATION BETWEEN LABORATORY ABRASION TESTS AND ROAD TESTS

by K. Satake, T. Sone, M. Hamada; K. Hayakawa

Published in *Rubber Chemistry and Technology* v44 n5 p1173-85 (Dec 1971)

11refs

Reprinted from *Journal of the IRI* v4 p217-21 (1970).

Road tests were performed on 27 compounds determined by a composite experimental design and 12 compounds where polymers were differentiated in a single formulation. The correlation between laboratory tests and road tests was studied together with the effects of severity of abrasion conditions and aging on abrasion.

Search terms: Tire treads; Tire materials; Laboratory tests; Road tests; Polymers; Composite materials; Abrasion tests; Tire wear measurement; Tire tests; Tire properties; Tire test equipment; Mathematical models; Fatigue tests

HS-011 407 Fld. 5/22

TRUCK TIRE GROOVE CRACKING THEORY AND PRACTICE

by B. E. Clapson; G. J. Lake

Published in *Rubber Chemistry and Technology* v44 n5 p1186-1202 (Dec 1971)

18refs

Reprinted from *Rubber Journal* v152 n12 p38-52 (1970). Presented at Institution of the Rubber Industry Symposium on Product Performance Testing, Trowbridge, England, Mar 1970.

The mechanism of groove cracking in tires was studied. Basic studies of the fracture mechanics of rubber have shown that the rate of growth of a crack is independent of sample shape and type of deformation when it is expressed in terms of the available elastic energy. An empirical method is described which enables the energy to be estimated for a tire groove from measurement of the amount by which a crack opens under stress. The method also enables the strain to be determined. Using this approach and the crack growth characteristics of the tread rubber, the rate of growth of groove cracks in a tire can be predicted. Satisfactory quantitative agreement is found between observed and predicted behavior suggesting that the mechanism has been correctly identified. The work indicates relevant design factors and material properties and enables an appropriate laboratory test for groove cracking resistance to be defined.

Search terms: Tire treads; Tire materials; Truck tires; Tire cuts; Tire failures; Laboratory tests; Tire design; Stress analysis; Breaking energy; Fracture mechanics; Failure stress; Deformation; Tire properties; Tensile strength; Elasticity; Mathematical models; Cracking

HS-011 408 Fld. 5/22

THE EFFECTS OF VARYING THE POLYMER COMPOSITION OF THE CUT GROWTH CHARACTERISTICS OF E/P/1,4 HD TIRE TREADS

by Charles W. Stewart; John J. Verbanc

Published in *Rubber Chemistry and Technology* v44 n5 p1203-7 (Dec 1971)

10refs

Reprinted from *Journal of Applied Polymer Science* 15 p949-54 (1971).

The purpose of this study was to determine the effects of changing the polymer composition on the performance of an ethylene-propylene-diene rubber based tread compound. The major emphasis was on cut growth characteristics, since early tire tests indicated that EPDM tread compounds had a tendency to groove crack to a serious extent. The tearing energy criterion was used in a laboratory test to predict the groove cracking behavior of the tires made from these polymers. Road test results indicate that ethylene-propylene-1, 4-hexadiene tripolymers containing 36-42% propylene and 1.8-2.2% diene exhibit resistance to cut growth and abrasion which is superior to standard bias tire materials. Polymers containing more than 42% propylene or 2.2% diene were inferior in wear and resistance to groove cracking, but sufficient data are not available to pinpoint the reason.

Search terms: Tire treads; Tire materials; Laboratory tests; Road tests; Tire failures; Tire cuts; Polymers; Propylene; Ethylene; Dienes

NHTSA DOCUMENTS

NHTSA Contractors Reports

HS-800 661 Fld. 1/3; 5/17

A STUDY TO DETERMINE THE RELATIONSHIP BETWEEN VEHICLE DEFECTS AND CRASHES. INTERIM REPORT

by John R. Treat; Kent B. Joscelyn

Indiana Univ.

1971 365p

Contract DOT-HS-034-2-263

Report no. DOT-HS-034-2-263-71-A

**NHTSA Contractor's Reports
(Cont'd.)****HS-800 661 (Cont'd.)**

Procedures and techniques developed in conjunction with a tri-level accident investigation program are reported, including data collection forms, accompanying criteria and instructions. The objective was the identification of all pre-crash accident causative factors, particularly vehicular factors. The three levels of the investigation program are: collection of baseline information on the vehicle, driver, and roadway/environmental populations; on-site investigation of approximately 600 accidents per year in Monroe County Indiana; and additional in-depth multidisciplinary investigation of a random sample of about 25% of these same accidents. Findings will be reported in a subsequent volume.

Search terms: Defective vehicles; Failure caused accidents; Accident causes; Data acquisition; Accident investigation; Multidisciplinary teams; Precrash phase; Driver vehicle road interfaces; Environmental factors; Trilevel accident investigation; Indiana; Accident report forms

AVAILABILITY: NTIS**HS-800 669 Fld. 2/11****UPDATE OF OPERATIONS
SYSTEMS DIRECTORY. FINAL
REPORT**

GENASYS Corp.

1972 19p
Contract DOT-HS-137-2-296

The purpose of this survey was to update the State Traffic Records Inventory for subsequent update of its Operations Systems Directory. The original inventory was conducted in 1968-70, and much of that data is outdated. The reinventory of six selected states was conducted and a new inventory document prepared for each. Emphasis was

placed on the automated files, especially those which were identified in the original inventory as manual files and have since been automated. The results of the project include the new inventory document for the six states, Alabama, Florida, Louisiana, Oklahoma, South Carolina, and Texas. These new inventories cover all files, automated and manual. A recommended schedule for the update, by on-site visit, of all states is included.

Search terms: Traffic records; Alabama; Florida; Louisiana; Oklahoma; South Carolina; Texas; Computerized records management; Computerized safety research techniques; Information systems

AVAILABILITY: NTIS**HS-800 671 Fld. 5/18****AN EXPERIMENTAL INVESTIGATION OF THE UNSTEADY AERODYNAMICS OF PASSING HIGHWAY VEHICLES. FINAL REPORT**

by Glen J. Brown; Gerald R. Seemann

Developmental Sciences, Inc.

1972 92p 6refs
Contract DOT-HS-102-1-147

The forces and moments experienced by certain passenger cars are measured as a function of time as the vehicles are disturbed aerodynamically by passing buses and trucks in the influence of sidewinds. These measurements are made on 1/10 scale models moving at actual speeds of up to 70 mph. The situations studied include passing encounters in which autos pass and are passed by the disturbing bus or truck traveling in the same direction as well as opposite directions. The disturbed vehicles include an intermediate sedan, a popular foreign sedan, and a 20 ft. travel trailer being pulled by an intermediate sedan. Disturbing vehicles include 96- and

102-inch-wide buses and 96- and 102-inch-wide semitrailer combinations. Parameters varied for these tests were vehicle lateral separation, speeds, relative direction, and side wind velocity. Results show the difference in terms of peak forces between various disturbing vehicles. Force signatures are usable for computer simulation and results have vehicle safety implications.

Search terms: Wind forces; Crosswind; Automobile stability; Vehicle stability; Vehicle size; Scale models; Trucks; Buses; Passing; Aerodynamics; Foreign automobiles; Travel trailers; Vehicle width; Semitrailers; Lateral vehicle spacing; Speed studies; Computerized simulation; Lateral force; Mathematical models; Time factors

AVAILABILITY: NTIS**HS-800 672 Fld. 5/18****AN EXPERIMENTAL INVESTIGATION OF THE UNSTEADY AERODYNAMICS OF PASSING HIGHWAY VEHICLES. SUMMARY REPORT**

by Glen J. Brown; Gerald R. Seemann

Developmental Sciences, Inc.

1972 10p
Contract DOT-HS-102-1-147

A Report Summary

For abstract and search terms set HS-800 671.

AVAILABILITY: NTIS**HS-800 676 Fld. 5/18****PANEL EVALUATION OF THE NHTSA APPROACH TO THE 1960-1963 CORVAIR HANDLING AND STABILITY**

by Harley E. Holt

General Testing Labs., Inc.

1972 27p 36refs
Contract NHTSA-2-2306

The National Highway Traffic Safety Administration has reviewed available data on the Corvair and has tested the vehicle. A panel of independent engineers evaluated the objectivity of the NHTSA testing and analysis. The panel concluded that: the handling characteristics of the 1960-63 Corvair had been appropriately and sufficiently defined; not enough data is available in the area of actual frequency of accidents to allow a valid determination to be made as to whether the Corvair has been involved in more accidents than contemporary cars; and the only real issue appeared to be whether or not the average driver can cope with a rapid change from understeer to oversteer during a period of stress.

Search terms: Corvairs; Automobile handling; Automobile stability; Automobile performance; Automobile safety characteristics; Automobile comparisons; Loss of control; Automobile tests; Rollover accidents; Compact automobile accidents; Accident studies; Understeer; Oversteer; Neutral steer; Lateral acceleration; Acceleration response; Automotive industry general attacks

AVAILABILITY: NTIS

NHTSA Staff Speeches, Papers, etc.

HS-810 205 Fld. 2/0; 3/1

REMARKS AT SYMPOSIUM ON ALCOHOL, DRUGS, AND DRIVING

by James E. Wilson

National Hwy. Traf. Safety Administration

1972 11p

Presented at Bolling Air Force Base Officers Club, 8 Jun 1972.

The Highway Safety Act of 1966 and the safety standards are described. The problem of inconsistency in treatment of traffic offenses is discussed. The safety standards are now being consolidated and some new requirements added. The drinking driver problem is briefly discussed.

Search terms: Highway Safety Act of 1966; Safety standards; Traffic law violations; Drinking drivers; Law uniformity

AVAILABILITY: NHTSA

HS-810 210 Fld. 3/1

ALCOHOL SAFETY COUNTER-MEASURES PROGRAM

by Charles H. Hartman

National Hwy. Traf. Safety Administration

1972 18p

Presented at Alcohol/Drug Traffic Safety Workshop, University of Wisconsin, Platteville, 12 Jul 1972.

The Department of Transportation's program for dealing with abusive drinker-drivers is described. Aspects discussed include the roles of social drinkers and problem drinkers in causing highway crashes; blood alcohol levels; research and development programs dealing with drinking drivers; public information programs; Alcohol Safety Action Projects; state and community matching grant programs.

Search terms: Drinking drivers; Driver intoxication; Problem drivers; Alcoholism; Accident causes; Blood alcohol levels; Alcohol education; Alcohol usage deterrents; Alcohol Safety Action Projects; Social drinking; State action; Community support; Federal aid; Grants

AVAILABILITY: NHTSA

HS-810 211 Fld. 2/0; 4/2

STATEMENT FOR THE RECORD BEFORE THE SUBCOMMITTEE ON ROADS, COMMITTEE ON PUBLIC WORKS, U. S. HOUSE OF REPRESENTATIVES, FEB. 17, 1972

by Douglas W. Toms

National Hwy. Traf. Safety Administration

1972 87p

Highway safety responsibilities and programs supporting the state and community highway programs are described. Program accomplishments and plans are discussed relating to driver control through licensing rehabilitation, traffic law adjudication, and police traffic enforcement; alcohol countermeasures; codes and laws; driver education; pedestrian safety, emergency medical services; motor vehicle inspection; safety manpower development. The consolidation of highway safety standards is also discussed.

Search terms: Federal aid; Highway safety programs; State action; Community support; Federal state relationships; Driver licensing; Driver rehabilitation; Traffic law enforcement; Police traffic services; Alcohol usage deterrents; Traffic laws; Driver education; Pedestrian safety; Emergency medical services; Vehicle inspection; Manpower utilization; Highway safety standards; Alcohol Safety Action Projects

AVAILABILITY: NHTSA

HS-810 214 Fld. 2/0

TRAFFIC SAFETY FOR AMERICA

by Charles H. Hartman

National Hwy. Traf. Safety Administration

HS-810 214 (Cont'd.)

1972 28p

Presented to Automobile Dealers Association of West Virginia. White Sulphur Springs, 17 Jul 1972.

The role of safety standards is described, especially the motor vehicle safety standards. Benefit cost analysis and rule making procedures dealing with the establishment of standards are discussed. Three priority programs in the traffic safety effort at present are crash survivability, the experimental safety vehicle, and alcohol countermeasures. Programs dealing with these priorities are described.

Search terms: Highway safety programs; Vehicle safety standards; Benefit cost analysis; Rule making; Accident survivability; Crash-worthiness; Safety cars; Experimental vehicles; Alcohol usage deterrents

AVAILABILITY: NHTSA

NHTSA Imprints

HS-820 188 Fld. 5/9

VEHICLE-IN-USE PROGRAM PLAN

1972 35p

The policy, mission, and goals of the National Highway Traffic Safety Administration concerning motor vehicle inspection are described. Aspects included are concept of operations, program structure, support requirements, evaluation procedures, funding requirements, and program schedules.

Search terms: Vehicle inspection; Program evaluation; Appropriations; Highway safety organization management; National Highway Traffic Safety Administration; Used automobile standards; Manpower utilization

AVAILABILITY: NHTSA

HS-820 198 Fld. 5/18

EVALUATION OF THE 1960-1963 CORVAIR HANDLING AND STABILITY

National Hwy. Traf. Safety Administration

1972 138p refs

The Corvair evaluation included review of General Motors documents and test data, technical literature, all available accident data, and testing of the Corvair

and contemporary vehicles. Input-response type dynamic tests were used. To evaluate the objectivity of NHTSA testing and analysis, a three-man advisory panel of independent professional engineers reviewed results. Evaluation of the data and tests and recommendations from the advisory panel indicate that the 1960-63 Corvair understeers in the same manner as conventional passenger cars up to about 0.4g lateral acceleration, makes a transition from understeer through neutral steer to oversteer in a range from about 0.4g to 0.5g lateral acceleration, and reaches its limit of control at 0.6g sustained lateral acceleration. This transition does not result in abnormal potential for loss of control. Accident data indicate that the rollover rate is comparable to other light domestic cars. The handling and stability of the Corvair are at least as good as the performance of some contemporary vehicles.

Search terms: Corvairs; Automobile handling; Automobile stability; Automobile performance; Automobile safety characteristics; Automobile comparisons; Loss of control; Vehicle control; Dynamic tests; Automobile tests; Rollover accidents; Compact automobile accidents; Accident studies; Understeer; Oversteer; Neutral steer; Lateral acceleration; Acceleration response; Automotive industry general attacks

AVAILABILITY: NTIS



executive summary

A SYNOPSIS OF A RECENTLY RELEASED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION RESEARCH REPORT

DEPLOYABLE HEAD RESTRAINTS

FINAL REPORT

The purpose of this program was to develop and demonstrate deployable head restraint systems that automatically deploy to prevent crash injury without significantly compromising driver vision during normal vehicle operations.

Contract No.: FH-11-7612
Highway Safety Research Institute
The University of Michigan
Huron Parkway and Baxter Road
Ann Arbor, Michigan 48105

Award Amount: \$192,974.00
Contractual Period:
June 30, 1970 through June 30, 1971
Report Date: June 1971

DOT/HS-800 515 Final Report PB 202 536

BACKGROUND

Rear-end collisions are the most frequently occurring type of motor vehicle collision. During the year of 1968 there were 14.6 million accidents involving motor vehicles in the United States. Of that total, 49% or 7.04 million were same direction or rear-end type accidents (U.S. Bureau of Public Roads, 1970). The total number of fatal accidents during this same period was 46,800, with rear-end type accidents accounting for 9% or 4500 accidents. Thus, although the rear-end collision is a common type of accident, the fatality rate associated with it is low, particularly for the occupants of the vehicle being struck from the rear.

The characteristic types of injuries sustained by occupants of the struck vehicle in non-fatal accidents are the so-called "whiplash" or hyperextension injuries. These injuries range from minor temporary neck and back aches to severe injuries involving dislocated and fractured cervical vertebrae and spinal damage. Quite frequently the soft tissues and ligaments of the neck are torn or strained.

In spite of the non lethal nature of many whiplash injuries, the high frequency of occurrence of rear-end collisions and the resulting number of injuries produced by such accidents can create serious public health problems in terms of disability and medical expense.

Since January 1, 1969, all new automobiles manufactured for sale in the United States have been required to include head restraint protection for occupants at each outboard front seating position. The two most common forms of head restraint presently in use in automobiles are either fixed extensions of the seat back or a separate head cushion, which is adjustable for height, attached to the seat back. The FMVSS Standard 202 pertaining to head restraints requires that during a half-sine acceleration pulse of 8 to 9.6 G amplitude and 80 to 96 msec duration, the rearward rotation of the head relative to the torso shall be limited to 45 degrees by the action of the head restraint.

Current head restraint systems can provide protection for vehicle occupants during crashes. However, they

too often do not because of improper adjustment. In addition, they restrict rearward visibility for many drivers and are therefore a design compromise hopefully providing adequate protection while sacrificing not too much in rearward visibility. The concept of a deployable head restraint offers a promising solution to this problem. Since it would remain out of sight in the seat back until required, it would not compromise rearward visibility or comfort, and the size, shape and location of the deployed head restraint can be optimized with regard to biomechanical factors toward providing protection from oblique impacts in addition to rear-end impacts and rebounds.

GENERAL COMMENTS

The program to develop prototype deployable head restraint systems was carried out in the form of a series of interrelated tasks which culminated in the design, construction, and testing of the prototype systems. The three preliminary tasks were:

- Task 1. Define Deployable Head Restraint System Requirements
- Task 2. Evaluate Crash Sensors
- Task 3. Evaluate Deployable Head Restraint Configurations

Task 1 involved definition of the safety requirements of a deployable head-rest while Task 3 involved the evaluation of various concepts from the safety viewpoint as well as reliability, cost, tolerance to environmental conditions, etc. These two tasks were initiated simultaneously at the beginning of the project. A set of performance requirements was developed based on analytical studies simulating the motions experienced by an automobile occupant in a collision while actual hardware as proposed by such manufacturers as Eaton, Yale and Towne, Inc., Ensign Bickford Co. and Olin Corp., among others, was studied to determine the state of the art which has been reached by possible volume producers of deployable head restraint systems. Task 2 provided the necessary information on crash sensor characteristics to define system deployment times.

Following completion of the above tasks and construction of the prototype systems, a thorough test, development; and demonstration program was carried out to study the effectiveness of the deployable head restraint concept.

CONCLUSIONS AND RECOMMENDATIONS

● CONCLUSIONS

According to the contractor, the results of this study indicate that deployable head restraints are technically feasible and that they can provide a general level of performance better than conventional fixed head restraints. The deployable head restraint can be packaged in such a manner as to allow the short driver to see over it for rearward vision and still be highly effective in providing head restraint for the tall driver. By virtue of the fact that the head restraint is in place only when needed in an accident situation, it can be placed much further forward than a fixed head restraint resulting in greatly reduced motion of the occupant's head during a crash. The necessary forward placement of the head restraint is such that it would not impair the driver's ability to control the car following the crash and thus it can remain in place to guard against subsequent multiple collisions.

Of the two basic types of deployable head restraint designs studied in this program, the contractor feels that the inflatable systems seem to offer many advantages over rigid systems such as

- . Compact packaging
- . Low inertia during deployment
- . Great latitude in final deployed shape
- . Ability to expand fore and aft while deploying vertically.

These advantages are modified somewhat by the necessity for achieving adequate fore and aft stiffness in the inflatable systems. At this point in their development, bag type inflatable head restraints were found to require a rigid rotating flap to provide the necessary stiffness. The possibility of utilizing self-stiffening inflatable structures, such as dropweave fabric, offers a means of overcoming this drawback.

The inflatable deployable head restraint developed during this program proved to be extremely effective for both large and small occupants in crash simulations equivalent to car-to-car rear-end crash velocities of 20 mph, 60 mph and 80 mph. The system was evaluated using criteria based on the following concepts:

Minimization of both linear and rotational rearward head displacement.

Minimization of head linear and angular accelerations.

Minimization of differential motions of the head relative to the torso.

Minimization of occupant ramping up the seat back.

Minimization of occupant rebound.

The contractor found that the overall effectiveness of the head restraint system depends greatly upon the effectiveness of the seat back structure it is mounted on and upon the extent to which their overall responses are matched. The excellent results obtained in this program for the inflatable head restraint-seat combination demonstrate the value of well matched components in producing uniform occupant motions and the value of minimizing elastic energy storage by utilizing a basically rigid load carrying seat structure. As an example of the performance of the total system, the input sled pulse of Test A-373 (an 80 mph car-to-car equivalent velocity crash simulation with a peak acceleration of 40 G's) produced in the 95th percentile male dummy a peak head A-P acceleration of 42 G's, a peak head angular acceleration of 916 rad/sec² with a corresponding angular velocity peak of 16.8 rad/sec with no head-neck extension. Comparison of these results with estimated human concussive tolerance values given by Ommaya (1970) for head rotational motion of 1800 rad/sec² at 50 rad/sec indicate levels below those believed to be tolerable.

In contrast to the excellent performance of the head restraint system, sensing of rear-end crashes poses problems in some cases. For crashes involving significant collapse of conventional car rear-end structures existing, inertial type crash sensors appear to be adequate. However, there are many low speed collisions requiring head restraint where the acceleration levels overlap into the possible road noise range thereby rendering the inertial type crash sensor ineffective in discriminating a crash from a road shock. In addition, the response of present inertial sensors may not be rapid enough for future square wave type crash structures. Incorporation of a sensor system into the design of rear energy-absorbing bumpers may offer a possible solution to rear-end crash sensing difficulties. Head restraints are effective in frontal crashes when occupant rebound occurs and therefore a deployable head restraint should also be activated during frontal crashes.

● RECOMMENDATIONS

This program has demonstrated the basic feasibility of deployable head restraints; however, many areas of the

subject are in need of further study. The contractor recommends that future studies on deployable head restraint concentrate on the development of:

- Totally inflating systems with self-contained fore and aft stiffness
- Optimum inflatable head restraint shapes for oblique as well as direct rear-end impacts.
- New crash sensor concepts for sensing rear-end collisions.
- Optimized inflation devices with characteristics that produce minimal effect on malpositioned occupants and minimal noise.

The Contract Technical Manager has certified that the contractor's work has been satisfactorily completed and that all contractual obligations have been met.

The opinions, findings, and conclusions expressed in this summary are those of the contractor and not necessarily those of the National Highway Traffic Safety Administration.

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